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5. $x^2+3y^2=1+3xy$

a) $2x+6y\frac{dy}{dx}=3x\frac{dy}{dx}+y\cdot 3$

$6y\frac{dy}{dx}-3x\frac{dy}{dx}=3y-2x$

$\frac{dy}{dx}(6y-3x)=3y-2x$

$\frac{dy}{dx}=\frac{3y-2x}{6y-3x}$

b) $1+3y^2=1+3y$ $(1,1)$ $(1,0)$

$y=1$ $m=\frac{1}{3}$ $m=\frac{2}{3}$

$y=0$

$y=\frac{1}{3}(x-1)+1$ $y=\frac{2}{3}(x-1)$

c) $\frac{3y-2x}{6y-3x}=\cancel{x}$

$\begin{cases} 6y-3x=0 \\ x^2+3y^2=1+3xy \end{cases}$

$6y=3x$

$x=2y$

$(2y)^2+3y^2=1+3(2y)y$

$7y^2=1+6y^2$

$y^2=1$

$y=\pm 1$

$x=\pm 2$

$(2,1)$

$(-2,-1)$

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6 c) $\frac{dy}{dx}=x^2(2y+1)$ $(0,5)$

$\frac{dy}{2y+1}=x^2\,dx$ sep. of var

sov

$\int\frac{dy}{2y+1}=\int x^2\,dx$

$\frac{1}{2}\ln|2y+1|=\frac{x^3}{3}+c$

$\ln|2y+1|=\frac{2}{3}x^3+c$

$2y+1=e^{\frac{2}{3}x^3+c}$

$2y+1=e^{2/3x^3}\cdot e^c$

$2y+1=Ae^{\frac{2}{3}x^3}$

$y=\frac{Ae^{\frac{2}{3}x^3}-1}{2}$

$x=0$

$y=5$

$5=\frac{A-1}{2}$

$10=A-1$

$A=11$

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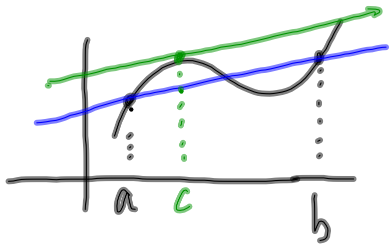
review 8 MVT

If $f(x)$ continuous on $[a,b]$ and differentiable on (a,b) then there is a value "c" between a & b :

slope of tan line → $f'(c) = \frac{f(b)-f(a)}{b-a}$ ← slope of secant line

inst rate ↑ ave ↑ rate



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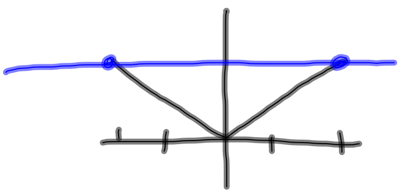
$y=|x|$ on $[-2, 2]$

Does MVT work?

NO



because $f(x)$ is not diff on $(-2,2)$

$\frac{f(2)-f(-2)}{2--2} = \frac{|2|-|-2|}{2--2} = 0$

$f'(x)=0$ never

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$f(x) = \sqrt{x-2}$

Find the value that satisfies the MVT on $[6, 11]$

$f'(x) = \frac{1}{2}(x-2)^{-\frac{1}{2}} = \frac{1}{2\sqrt{x-2}}$

$f'(c) = \frac{1}{2\sqrt{c-2}}$

ave rate $= \frac{\sqrt{11-2} - \sqrt{6-2}}{11-6} = \frac{1}{5}$

$\frac{1}{5} = \frac{1}{2\sqrt{c-2}}$ solve for c

$2\sqrt{c-2} = 5$

$\sqrt{c-2} = \frac{5}{2}$

$c-2 = \frac{25}{4}$

$c = \frac{25}{4} + 2$

$c = 8\frac{1}{4}$

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